

as simple a result as possible, even if approximate, but really because his is not the correct solution of a problem, that obtained by Saint Venant's method involving series of transcendental functions. We miss the well-known equilateral triangle and the algebraic solutions representing sections approximately square. Chapter x. deals with the collapse (*flambement*) of beams under end thrust or torsion.

"The elements of the mathematical theory of elasticity" is the title of the last chapter. In it the differential equations of elasticity are expressed in terms of the displacements, and the applications include wave-propagation, Saint Venant's torsion problem (still without reference to the rectangle or equilateral triangle), Boussinesq's and Hertz's theorems.

A special feature of the book is the collection of examples at the end of each chapter. These, of which the solutions are given, are, as examples should be, mostly straightforward applications, frequently numerical, of the bookwork, and though some of them are necessarily rather long, none of them are without some practical interest. It is very likely that many a mathematician brought up on tripos riders might find the numerical calculations puzzling at first, but is it not essential to understanding a theory properly that it should be tested by numerical examples and not merely by "neat analytical results"? Another feature is the synopsis of formulæ at the end of the book.

This is not exactly the book which a mathematician would use to learn elasticity from by preference, but then it was not written for mathematicians. In endeavouring to present the theory of elasticity in the most practical aspect possible so as to bring it within the range of engineering students, the author appears to have achieved his object with remarkable success, or in the conventional words of the reviewer, "this book is admirably adapted to the requirements of the class of readers for whom it is specially written."

DETERMINATIVE BACTERIOLOGY.

A Manual of Determinative Bacteriology. By Frederick D. Chester. Pp. vi + 401. (New York: The Macmillan Company, 1901; London: Macmillan and Co., Ltd.) Price 10s. 6d. net.

ALL branches of science in the early stages of their development suffer from the want of a uniform nomenclature. But it is in the biological sciences, especially zoology and botany, that the greatest confusion has prevailed, more particularly in the naming of the multitudinous forms of animal and plant life. Thanks, however, to the codes of rules drawn up at various conferences, and more or less universally accepted, the systematic nomenclature of zoology and botany has become much more uniform and simple, while these branches both possess a recognised terminology for descriptive purposes.

It is otherwise with bacteriology. This science, though primarily a branch of botany, has been mainly developed by those who could not claim to be trained botanists, and the bacteria have been studied and classified with little reference to the relations existing among themselves and to allied forms; hence the nomenclature, both systematic and descriptive, is in a chaotic state. Moreover, descrip-

tions of new forms are continually appearing in a number of journals, so that it is extremely difficult without an enormous expenditure of time to discover whether a form has previously been described or no, as hitherto there has been no catalogue of species available. It is with a view to purge bacteriology of some of these reproaches that the present work has been compiled. The author modestly states in the preface that he "does not claim that the system of arrangement is perfect. . . . The present tables serve, therefore, only for purposes of identification and not necessarily for those of classification." The opening chapter is devoted to an account of the morphology and biology of the bacteria; in the second a genuine attempt is made to devise a system of terminology for descriptive purposes. The various forms of growths, of colonies, &c., receive appropriate names, so that what was formerly a long description may be condensed into a few words. For instance, the gelatin stab culture of anthrax is "an arborescent growth becoming a crateriform to saccate liquefaction," and the agar colonies of the same organism are simply "floccose." The preparation of standard nutrient media is then described, a reaction of + 0.5 being preferred to that of + 1.5 adopted by the Committee of the American Public Health Association. Some staining methods are next briefly mentioned, and a few pages are devoted to a study of the chemical functions of bacteria, a table of chemical separations, and a scheme for the study of bacteria.

In chapter iii. the classification of the bacteria is dealt with, that adopted being on the basis of the one described by Migula in his "System der Bakterien," and the various species are tabulated at length and upon a definite scheme. This portion of the book occupies more than 300 pages and must have entailed considerable labour in its compilation. The cultural and other characters of each organism are described upon a consistent plan, while the various species are divided up into small groups by certain prominent characteristics, such as chromogenic, liquefying, Gram-staining and other properties. By this subdivision, and the synopsis of characters given before each group, it is possible, as the author points out, to place a culture in the hands of a student and for him to determine the species. Those who are acquainted with the older works of Eisenberg, Lustig, &c., will accord a hearty welcome to these tables. The classification, as stated before, is that of Migula, but the nomenclature of species has been made to accord with the rules of botanical nomenclature, with a rigid insistence upon binomial names and upon the rule of priority. At the same time, the synonymy of, and earliest reference to, each species is given. This is no doubt a great advance, though perhaps inconvenient at first, as it involves the re-naming of a number of familiar species, sometimes with far less appropriate names than they have at present. For example, the bacillus of mouse septicæmia was conveniently termed the *Bacillus murisepticus* by Flügge in 1886, but a year previously Trevisan had named it the *Bacterium insidiosum*, and therefore "*insidiosus*," by the rule of priority, must stand as the specific name. Curiously enough, having discussed this very organism as an example of the rule of priority at length at p. 48, when it comes to the actual description of it (p. 353) the author tabulates it as *Mycobacterium murisepticum* in-

stead of "*insidiosum*," as, from his own showing, it should be. Similarly, the bacillus of hog cholera, the *B. suispestifer*, Kruse, becomes the *B. Salmoni*; the organism of chicken cholera the *B. cholerae*; Koch's comma bacillus of cholera *Microspira comma*, &c.

In a work which as a whole is so excellent, it would be invidious to criticise minor points, and the following remarks should therefore be regarded as suggestions for amendment in a future edition.

The description of the *Bacillus enteritidis*, Gärtner, is too brief, and this organism does not ferment lactose. All peritrichic forms are indicated by a "B" in heavy type. Those which are presumably so, but about which there is no definite information, are designated by a "B" in lighter type; the distinction between the two letters should be made more marked. The *B. Welchii* and *B. emphysematosum* (p. 183) are, according to Welch, identical. In places the terminology needs revision, e.g. *M. eczema* (p. 86) and *M. epidermis* (p. 62). The reviewer has searched in vain for any mention of the *Micrococcus melitensis*.

While the index is a very full one, it might be yet more complete with advantage—for example, in all cases both the ordinary name and the one adopted should be given, but this is not done. Anyone searching for the *M. agilis* would not find it unless he knew that the organism was flagellated and belonged to the genus *Planococcus*. There is no reason why "*Bacterium*" should be indexed before "*Bacillus*." The *B. aërogenes capsulatus* is wrongly indexed (p. 269, instead of p. 183). The work concludes with a glossary of terms and a short bibliography. As regards the latter, one reference reads "*Trevisan-de-Toni, &c.*"; it should be "*Trevisan and de Toni in, &c.*" Moreover, another work by Trevisan, "*Gen. e spec. delle Batteriaceæ*" (1889), although frequently alluded to in the text, is not mentioned in the bibliography.

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STRATIGRAPHICAL GEOLOGY.

The Student's Handbook of Stratigraphical Geology.

By A. J. Jukes-Browne, B.A., F.G.S. Pp. xii + 589.
(London: Edward Stanford, 1902.) Price 12s. net.

AS stated in the author's preface, "this volume is based upon the 'Student's Handbook of Historical Geology' published by Messrs. G. Bell and Sons, and may be regarded as a second edition of that book." It has been entirely rewritten, however, and brought up to date; moreover, the alterations and additions are so numerous and important that to describe it without qualification merely as a second edition of that work is, we think, to give a wrong impression of its increased merits.

The former book, which was published in 1886, was in most respects an excellent work and contained a surprising amount of information; but, in our opinion, it had a serious defect. It was somewhat lacking in interest, dry, and not very readable. Fortunately for the student, this fault, which it is very difficult, often impossible, to avoid when, as in this case, the information to be imparted consists in the main of the statement of a host of details, has in the present volume been largely remedied; and the author is to be congratulated upon the manner in

which, while greatly augmenting the number of recorded facts, he has succeeded in maintaining the general interest of his subject.

Of the eighteen chapters which comprise the text of the volume, the first four deal with the principles involved in the science of stratigraphy. They follow the same general plan as was previously adopted. The fifth, however, is quite an innovation. It gives information to the student as to the principal works on general stratigraphy which are available in this country, and as to the facilities which exist for ascertaining what has been published, in the way of maps and special treatises, concerning the stratigraphical geology of any district in the British Isles of which he may wish to acquire a deeper knowledge. It should prove especially useful to students who are self-taught.

The remaining chapters are devoted to the study of the several geological systems, which are taken, as before, in the ascending order. The nomenclature adopted for the systems is simple and satisfactory. The substitution of the terms Palæogene and Neogene, originally suggested by Høernes for the Tertiary systems and now widely employed on the continent, in place of the terms Hantonian and Icenian used in the first edition, is, we think, an improvement in terminology. The chapters dealing with the Palæozoic systems have been very considerably expanded, with the result that these systems now receive a fairer share of attention than was the case in the first edition.

The author has adopted a capital plan of placing the literature-references at the end of each chapter, where, with the addition of such others as are necessary to make the list tolerably complete, they constitute a most useful bibliographical index of the subject dealt with in the chapter.

The main bulk of the book treats of British stratigraphy. Such accounts as are given of foreign rock-groups are comparatively short, and, except in a few special cases, are confined to those of the European continent. This, to some extent, limits the use and value of the book; but to us it seems that the author has done well to make his description of foreign strata quite subordinate to that of beds at home which every student has the opportunity of seeing and examining in the field for himself. In order to have included a satisfactory treatment both of British and foreign stratigraphy it would have been necessary to increase the size of the volume to such an extent that its cost would be prohibitive to most of those for whom it is especially written.

One of the greatest improvements in the book in its new form is the addition of a number of sketch-maps illustrating the geology of many of the more specially interesting districts in England and Wales. These, which are in part derived from previous publications and in part have been prepared for the work, from the maps of the Geological Survey, are clearly and effectively drawn, and greatly facilitate a ready comprehension of the text. The author's suggestion that the student should tint them with suitable washes of colour is a good one; the exercise intelligently carried out, besides enhancing the value of the diagrams, should also serve to impress the geology of each district more permanently upon his mind.